Integrated hydrologic effects of climate change in the Chuitna Watershed, Alaska

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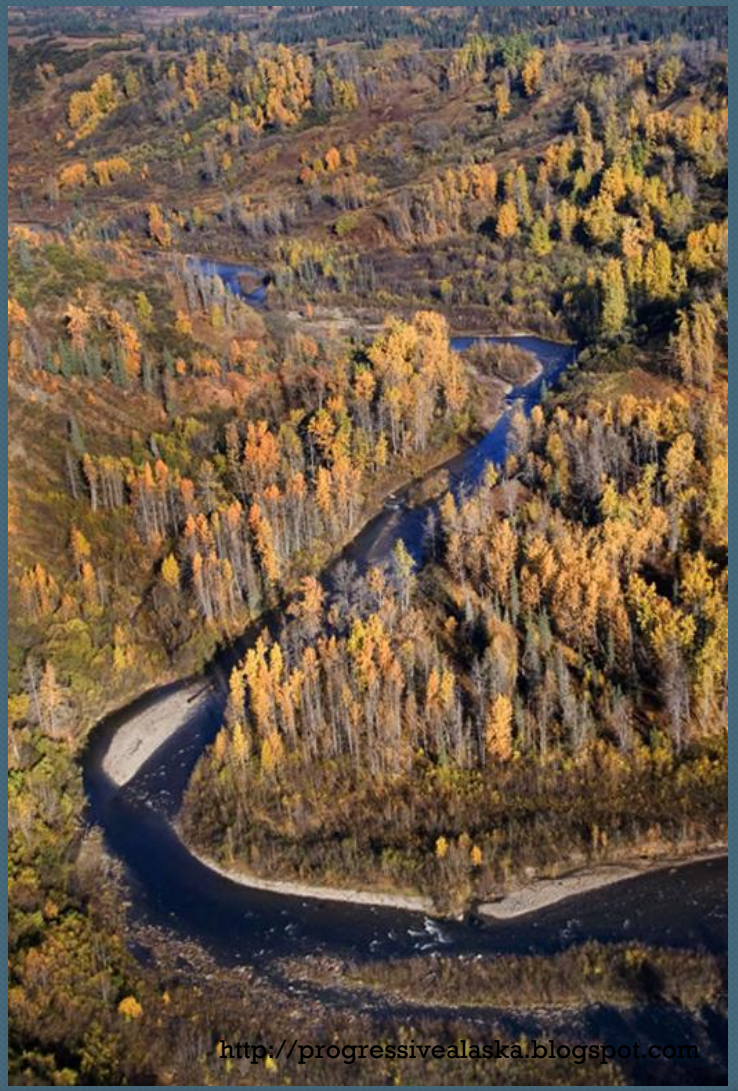
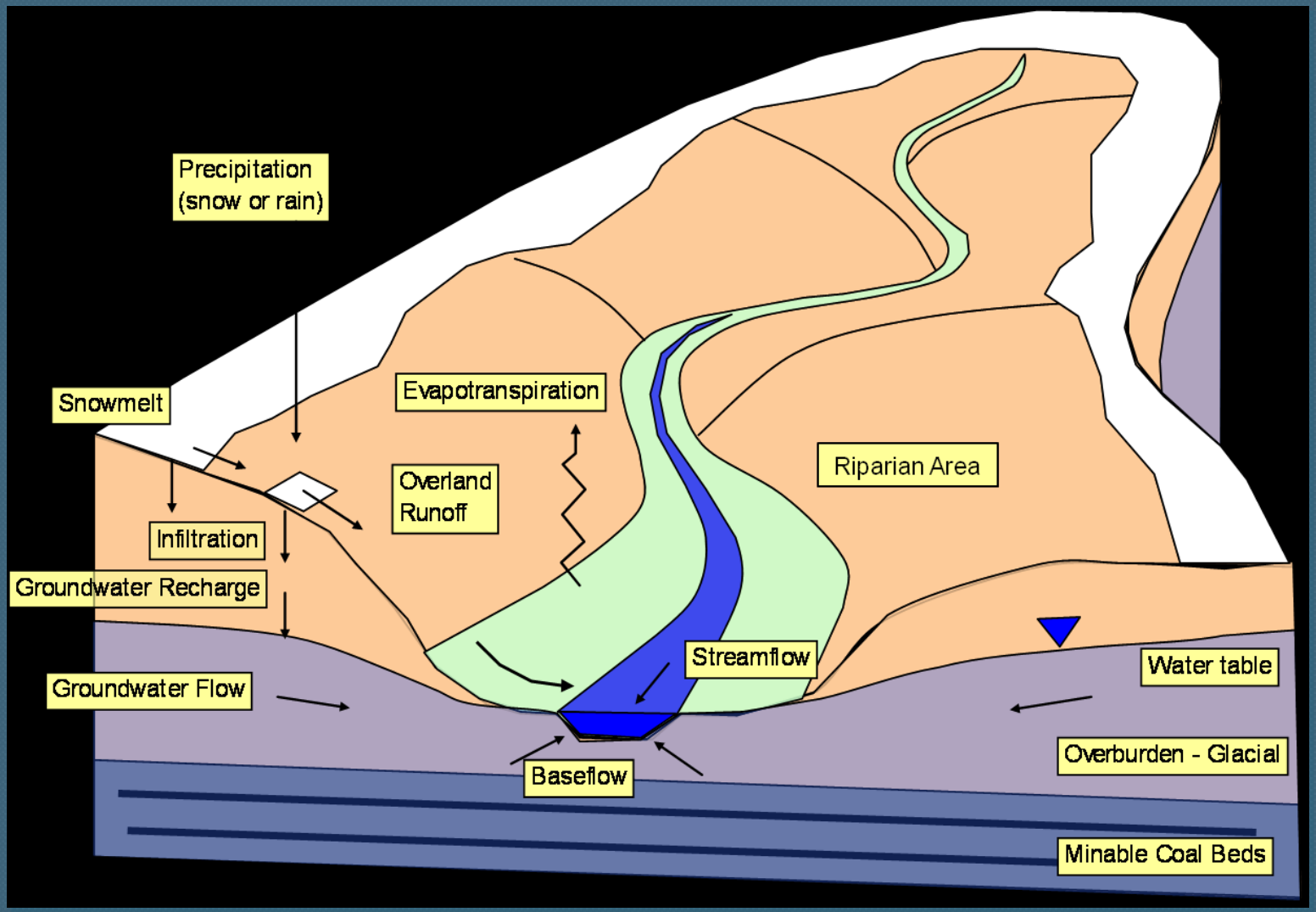
What will the Chuitna look like in the future?

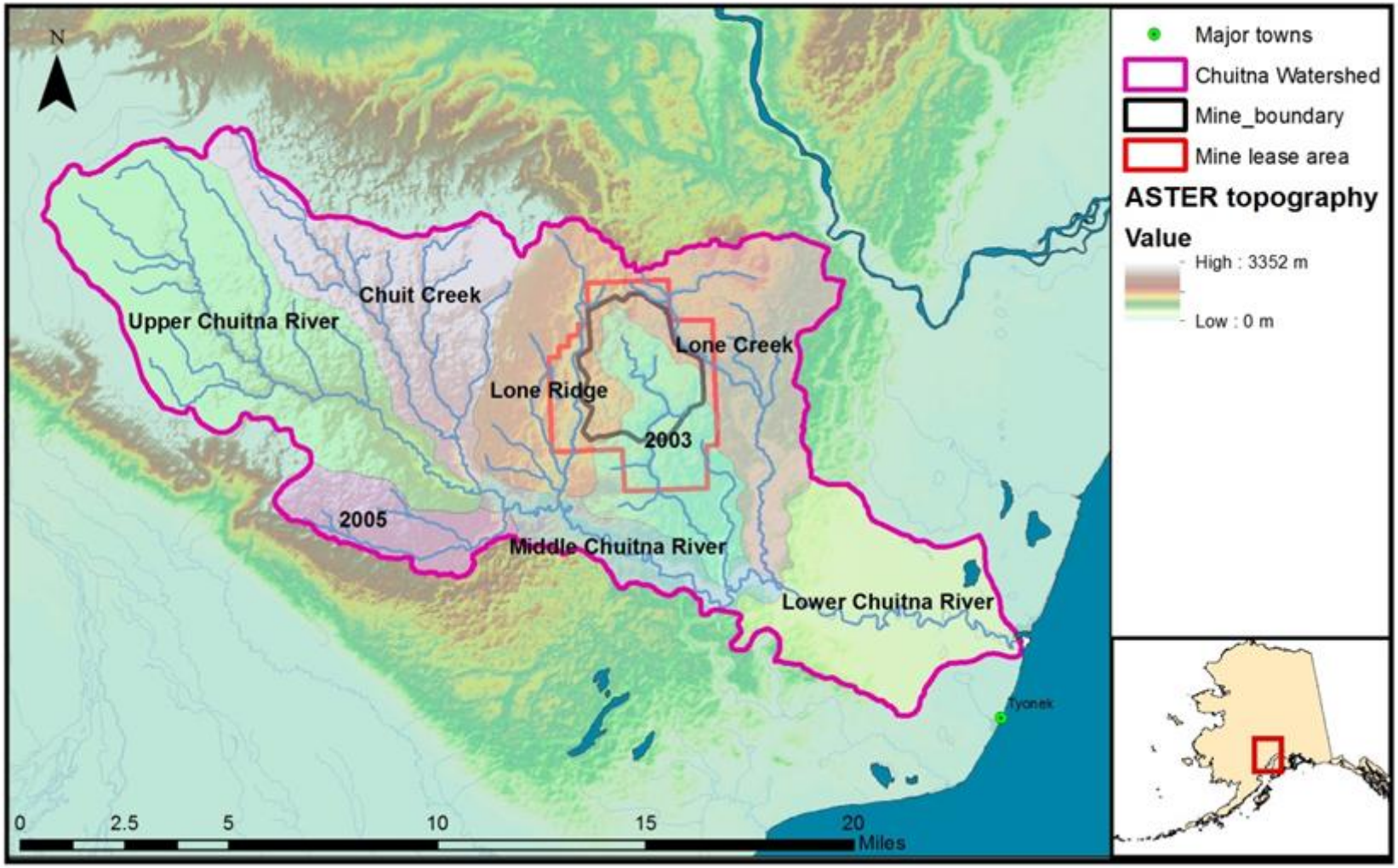
- Impact of climate change in the Chuitna Watershed?
- IPCC predictions:
  - 4-10 C° increase for AK
  - 6-50% precipitation increase for AK



What will the Chuitna look like in the 2100?



Chuitna Watershed and potential coal mine

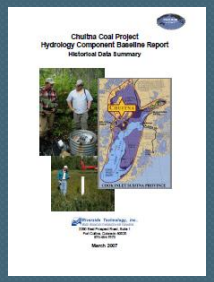


Methods:

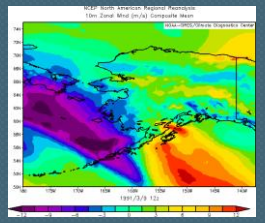
STEP 1- Model Existing System

Available Data

NHD GIS data



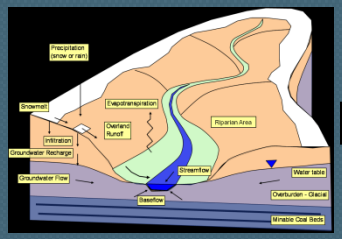
Consultant hydrologic data



North American Regional Reanalysis historic climate data

Calibration

Conceptual Flow Model



Numerical Flow Model

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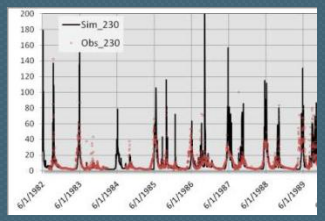
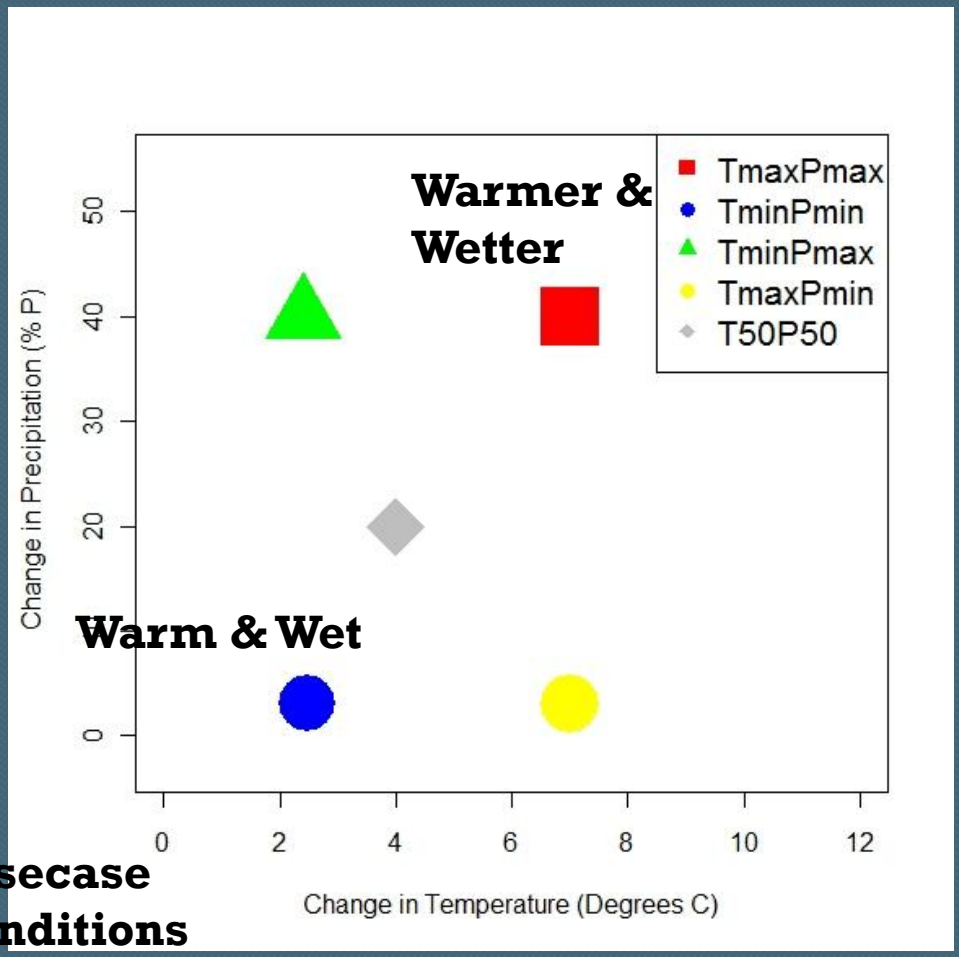
Simulating Historic Conditions



Refine model

Methods:
Step 2-Future climate scenarios

- A1B emission scenario from IPCC AR4 report
- Five future climate scenarios:
- Increased precipitation and air temperature
- TminPmin = +2.5C°: +3%P
- TmaxPmax = +7C° : +40%P

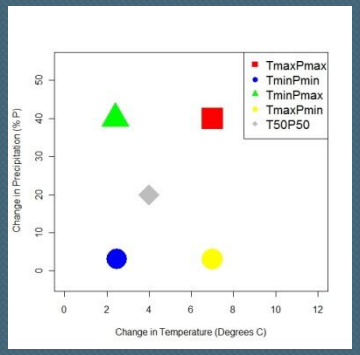


Basecase Conditions

Methods:

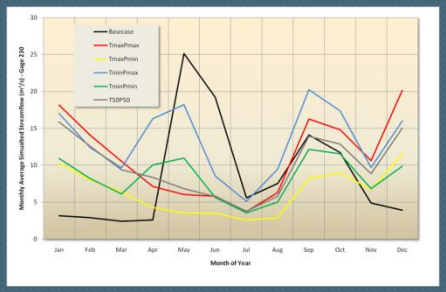
Step 3- Simulating Chuitna future hydrology

Chuitna future climate

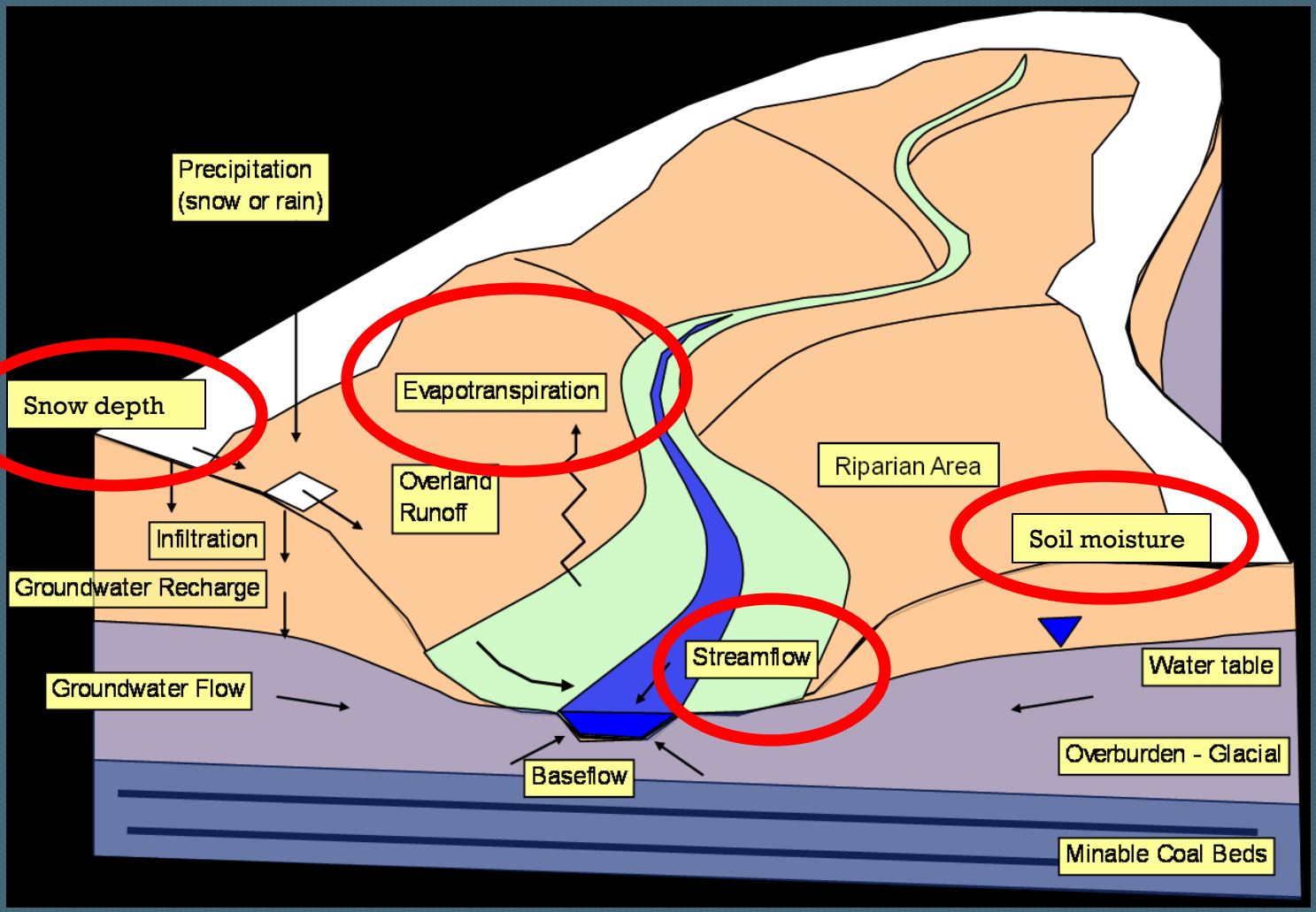


Chuitna Watershed Model

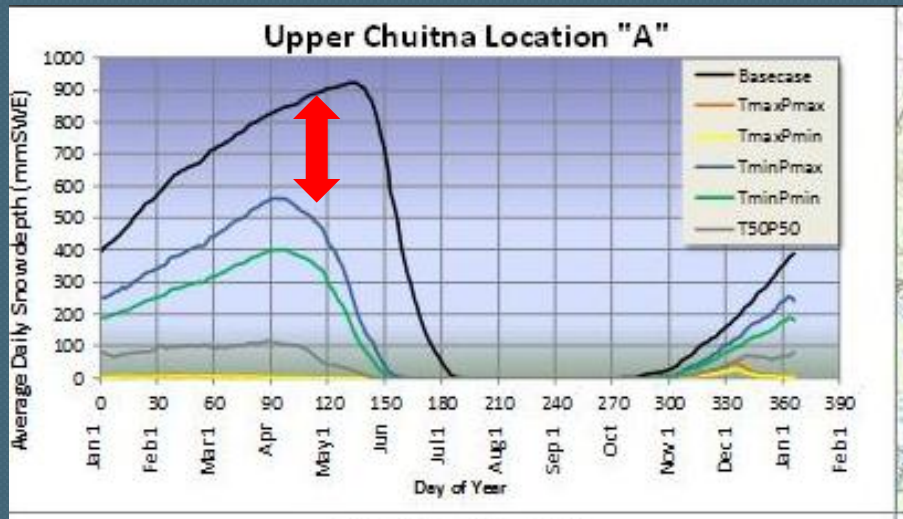
Chuitna Watershed future hydrology

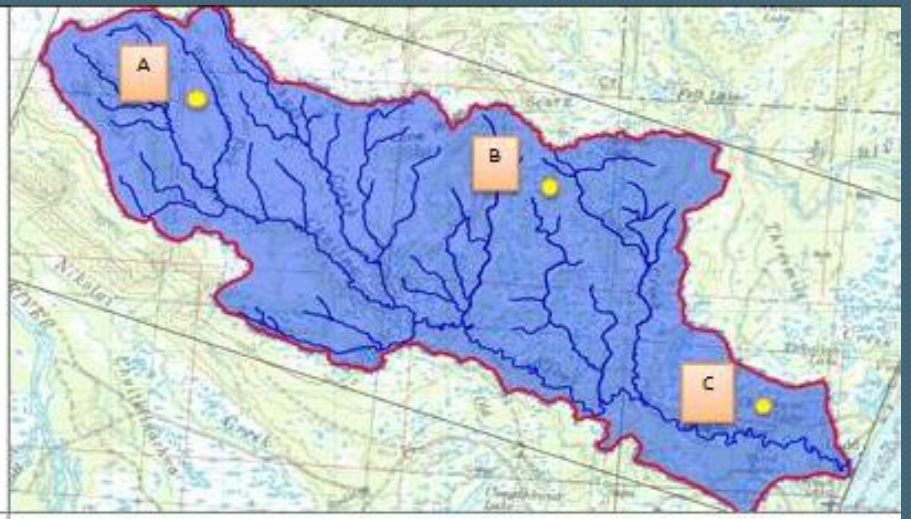


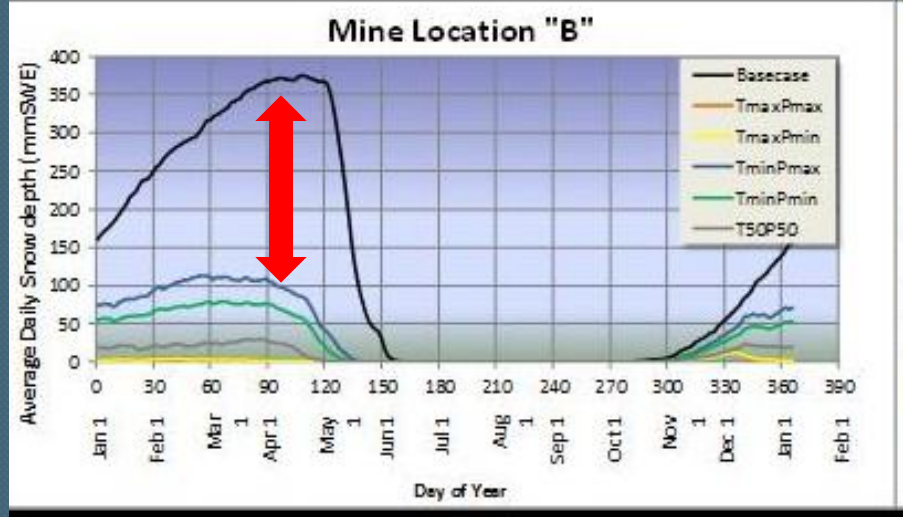
Results:

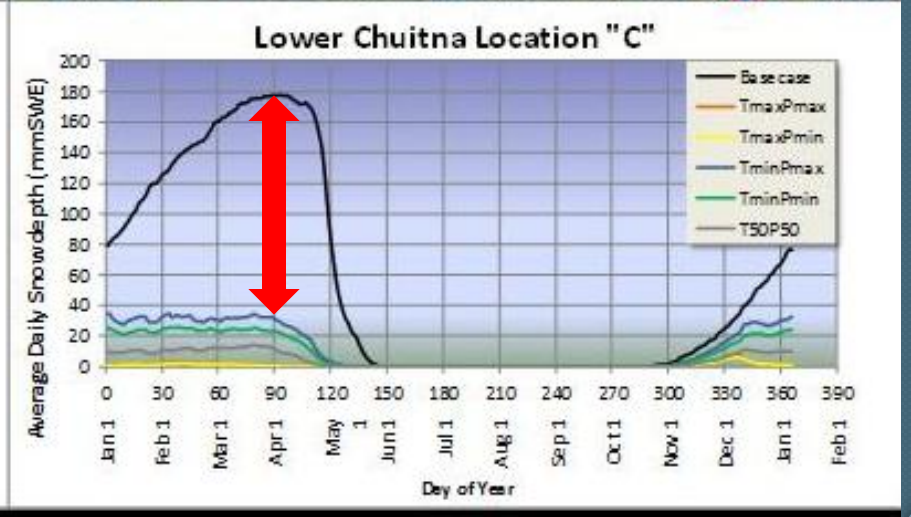

Precipitation
(snow or rain)
Snow depth
Evapotranspiration
Overland
Runoff
Riparian Area
Soil moisture
Infiltration
Groundwater Recharge
Streamflow
Water table
Groundwater Flow
Baseflow
Overburden - Glacial
Minable Coal Beds

Results:
Snow depth

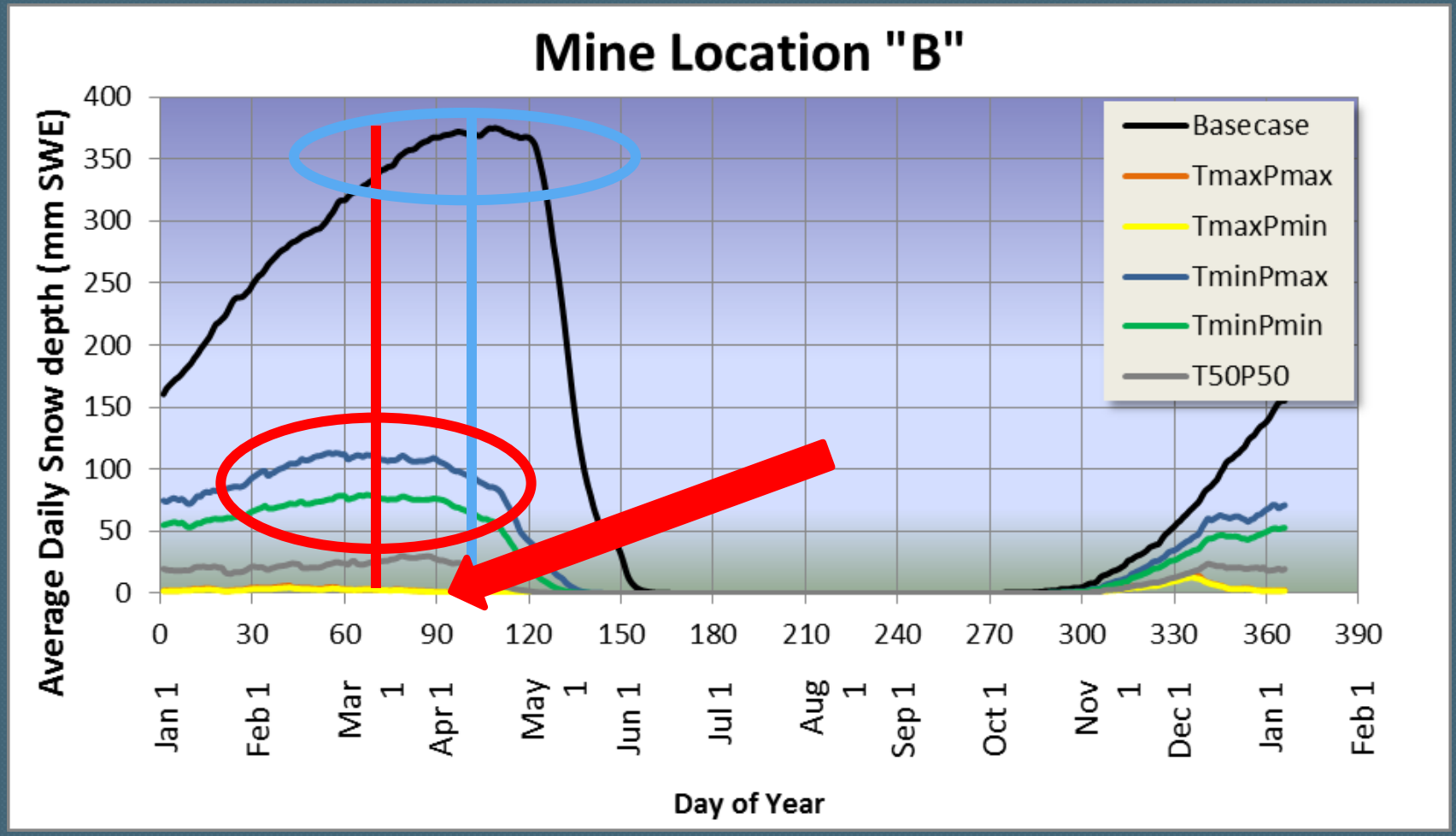




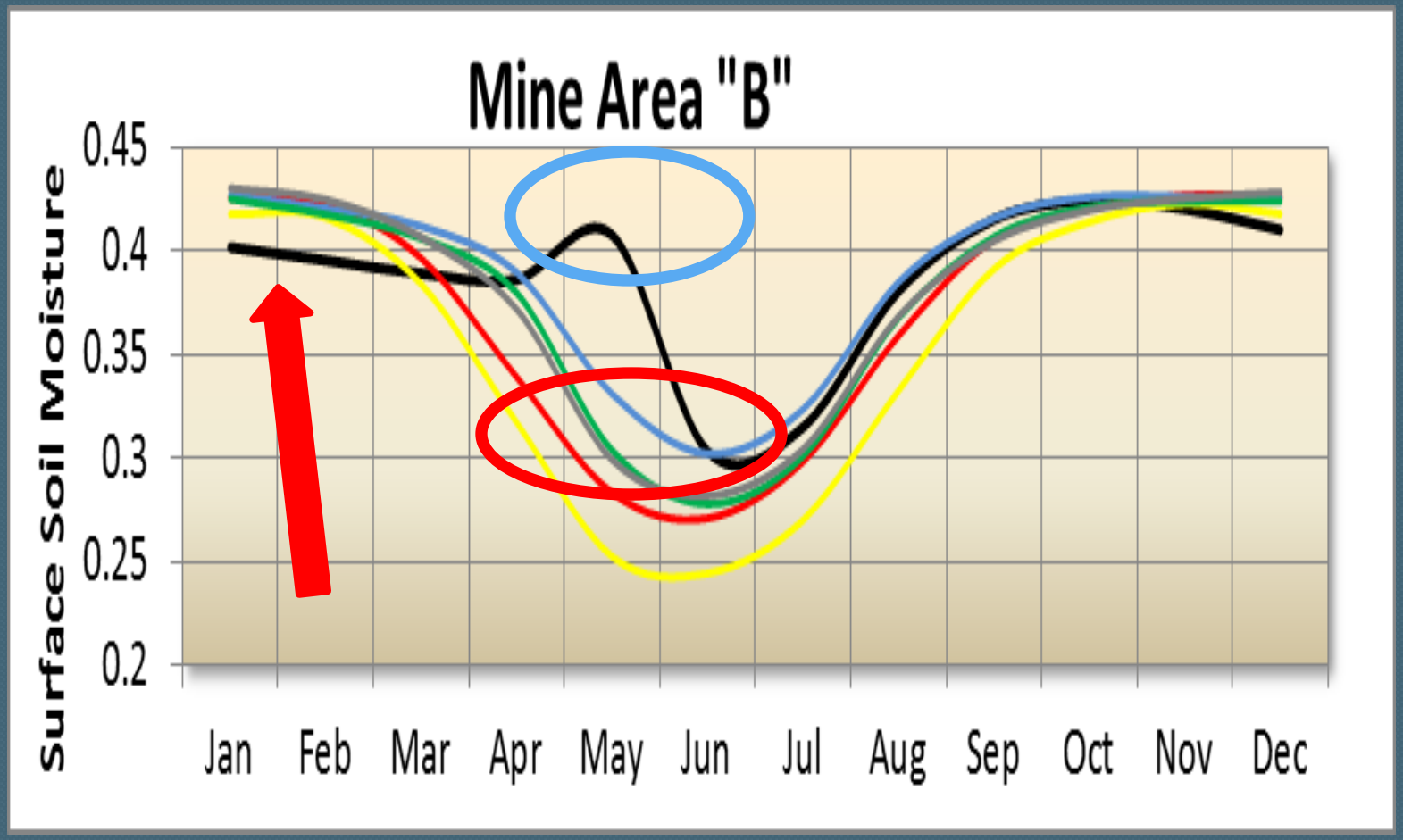




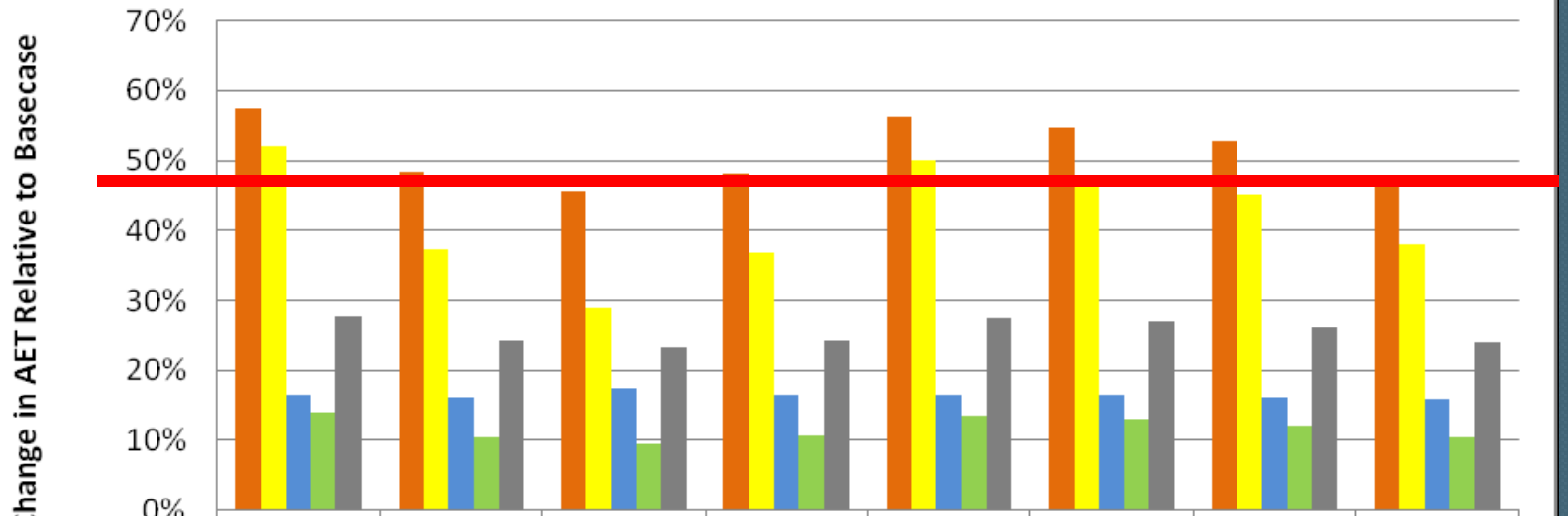
Results:
Snow depth



Results:
Soil moisture

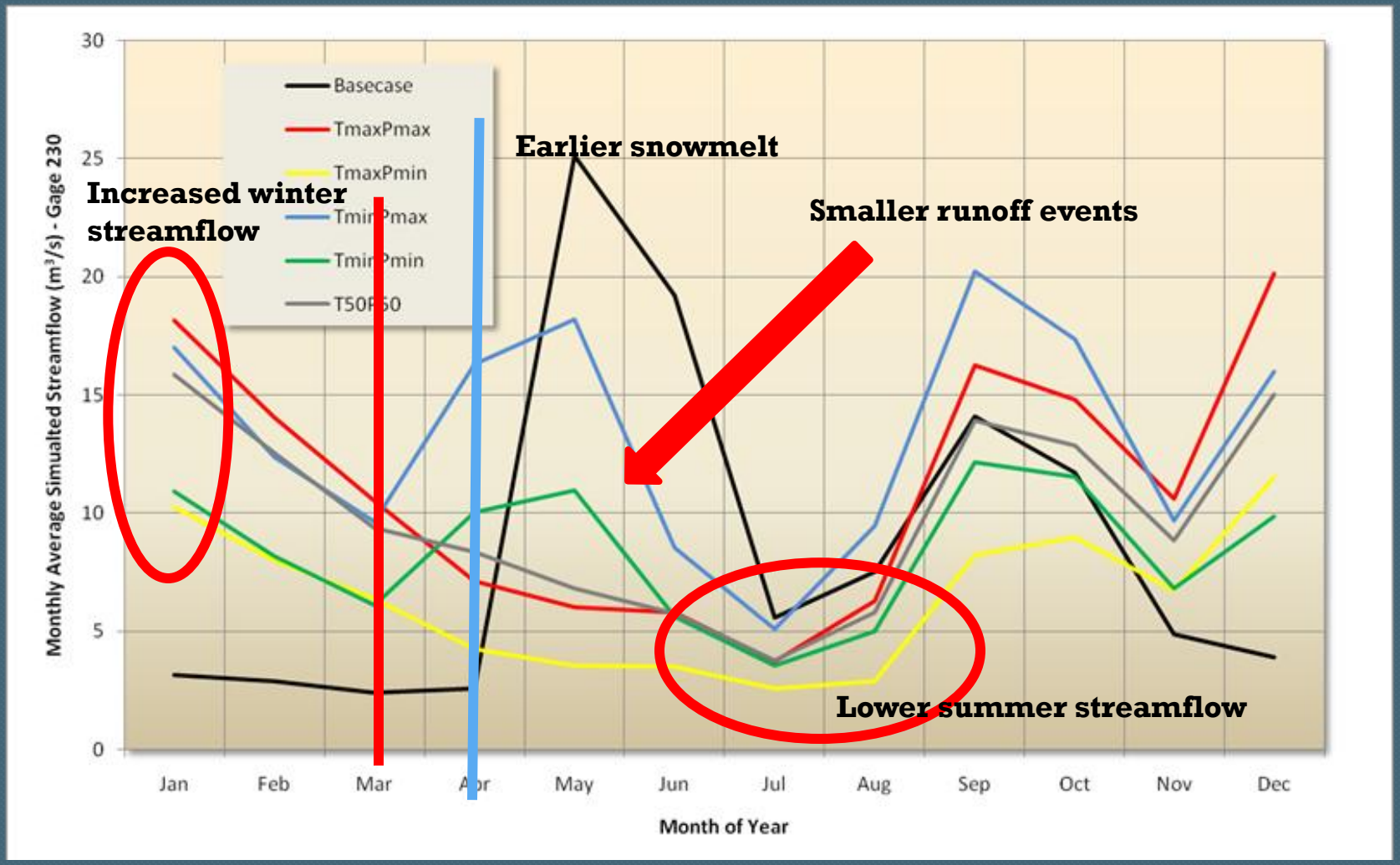


Results:
Change in AET



	Upper Chuitna	Middle Chuitna	Lower Chuitna	Lone Creek	Chuit Creek	Stream 2005	Stream 2004	Stream 2003
TmaxPmax	58%	48%	46%	48%	56%	55%	53%	48%
TmaxPmin	52%	37%	29%	37%	50%	48%	45%	38%
TminPmax	16%	16%	17%	16%	16%	16%	16%	16%
TminPmin	14%	10%	10%	11%	13%	13%	12%	10%
T50P50	28%	24%	23%	24%	28%	27%	26%	24%

Results:
Change in Streamflow



Summary

- Model calibration results are adequate for model
- Chuitna is a large complex watershed
- Major changes driven by temperature: increased AET and changes in winter snowpack
  - Change in the seasonal hydrograph
  - Increased winter streamflow
  - Lower summer streamflows

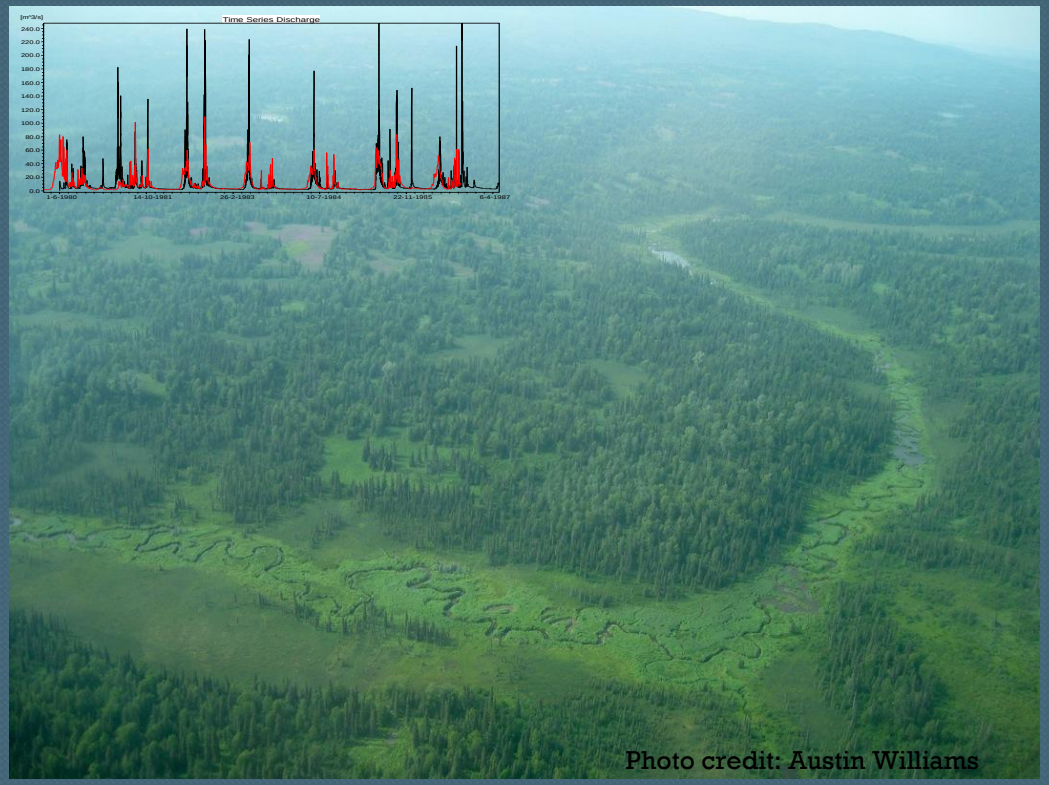


Photo credit: Austin Williams

Future work

- How will Coho salmon be affected?
- Use hydro-model results within life-cycle model
- Goal: How does climate change affect survival and capacity of Coho?

Acknowledgements

Funding:

Additional collaborators:

Phil Brna, Ann Rappoport and Frances Mann: US Fish and Wildlife Service; Scientific guidance and review

Sue Mauger; Science Director at Cook inlet keeper; Scientific guidance and review

Ron Burnett: Guided field visit during model Conceptualization